

over northern New England and Nova Scotia, disappearing to the eastward on the 27th.

IX.—This storm is the only one of the month which passed over the central portion of the United States. It was located as central in Colorado at midnight of the 25th and passed directly eastward, causing very heavy rains in the central valleys on the 26th and 27th. Severe local storms were reported in the Gulf States on the last-named date, with dangerous winds on the Gulf coast, which were apparently due to a secondary disturbance which formed in the lower Mississippi valley on the 26th, but which disappeared by a gradual increase of pressure after the centre of the principal disturbance reached the Ohio Valley. General rains occurred throughout the Southern and Northern States during the passage of this disturbance. On the afternoon of the 28th numerous local storms were reported in the middle Atlantic states, Ohio Valley, and southern New England. Minor depressions were formed near Lake Erie, in eastern Virginia, and in the upper Ohio valley. Rain continued on the middle Atlantic and New England coasts on the 29th, attended by strong northeasterly winds, which reached a maximum velocities of forty-four miles per hour at Sandy Hook, forty miles at

Block Island, and thirty-five miles at Atlantic City. The centre of this disturbance was last observed off the middle Atlantic coast on the 29th.

X.—Number x formed over the central plateau region on the 27th, and after moving to the central Rocky Mountain region apparently receded to the westward, after which it developed energy and moved in a northeasterly direction over Wyoming, and on the last day of the month it extended over the slope of the Rocky Mountains as a trough of low pressure, the centre being in western Nebraska.

XI.—This disturbance apparently approached the lower Saint Lawrence valley from the Hudson Bay region. The pressure decreased at the northeastern Canadian stations on the night of the 29th, and on the afternoon of the 30th there was a well-defined low area central in the Saint Lawrence Valley near Quebec. It passed southeastward over New England, and at midnight of the 30th general rains prevailed on the New England coast and dangerous winds occurred on the southern New England coast, the centre of disturbance being east of Portland and south of Eastport, Me. Between the afternoon and midnight of the 30th a maximum velocity of fifty miles per hour occurred at Block Island, R I.

NORTH ATLANTIC STORMS FOR JUNE, 1888.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that appeared over the north Atlantic Ocean during June, 1888, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depressions have been traced, of which six advanced eastward over or near Newfoundland; one first appeared north of the Azores; one apparently moved southeastward from Greenland; and one originated off the southern edge of the Banks of Newfoundland. The depressions generally pursued normal east-northeast tracks, with a rather slow rate of progression.

The month opened with moderate to fresh gales over the entire ocean, attending the presence of two areas of low pressure, located, respectively, to the northward of the Azores and on the middle Atlantic coast of the United States; over the southern portion of the British Isles the barometer was relatively high. From the 2d to the 4th, inclusive, the weather conditions continued unsettled, after which there was an apparent west to east translation of high barometric pressure until the 10th. From the 11th to the 14th fresh to strong gales prevailed from Newfoundland to the British Isles, which conditions were succeeded by an area of high pressure which extended eastward from the American coast during the 15th and 16th. During the balance of the second decade the barometer continued high east of the twentieth meridian, while in the vicinity of Newfoundland and the Grand Banks storms of moderate strength were encountered. From the 20th to the 25th generally fair weather prevailed over the British Isles; to the westward of the twentieth meridian this period was marked by fresh increasing to strong gales, and low barometric pressure. Subsequent to the 25th the winds were cyclonic off the west-central coast of Europe, attending the slow eastward passage of an area of low pressure. Over the ocean west of the thirtieth meridian the severest storms of the month occurred from the 26th to the 30th, inclusive, when barometer readings ranging to about 29.20 (741.7) were reported off the northeast edge of the Banks of Newfoundland.

In June, 1887, thirteen depressions were traced, of which one traversed the ocean from coast to coast; two appeared to the northward of the West Indies; two passed eastward over Newfoundland; one apparently originated southwest of the British Isles and moved northward; and eight developed over

mid-ocean. The progressive movement of the depressions was northeastward east of the thirtieth meridian, while to the westward of that longitude their course of direction was irregular. With the exception of rather strong summer gales to the westward of the twenty-fifth meridian during the second decade of the month, the general character of the weather over the north Atlantic was settled and seasonable. The lowest barometric reading reported in the trans-Atlantic routes was 29.30 (744.2), on the 15th, in N. 42° 53' W. 57° 31'.

As compared with the corresponding month of previous years, the general character of the weather over the north Atlantic Ocean during June, 1888, was seasonable. The depressions which appeared were deficient in number, and storms of marked strength were not reported save during the last few days of the month. The development of storms in the tropical or sub-tropical regions of the West Indies and the Gulf of Mexico was not indicated.

In the following descriptions of the depressions traced positions are given in degrees, latitude and longitude, except in cases where twenty-five to thirty-five minutes are cited, when they are shown in degrees and half degrees:

1.—This storm was a continuation of depression number 11 traced for May, 1888, and was central June 1st in about N. 44°, W. 30°, with pressure falling below 29.40 (746.7), and fresh to strong gales; by the 3d the storm-centre had advanced northeast to the twentieth meridian, with an appreciable diminution in energy, after which it recurved southeastward, and disappeared in the direction of the Bay of Biscay after the 4th.

2.—This depression apparently originated off the middle Atlantic coast of the United States during the 2d, whence it moved northeast to N. 41°, W. 63° by the 3d, with pressure about 29.80 (756.9); by the 4th the centre of depression had passed north-northeast to Newfoundland, and thence moved eastward to the forty-second meridian by the 5th. During the next three days the depression pursued a course to the southern extremity of Ireland, where it was central on the 8th, attended by a gradual decrease in barometric pressure, and moderate to fresh gales, after which it disappeared beyond the region of observation.

3.—This depression was a continuation of land low area number i which passed eastward over the Gulf of Saint Lawrence and Newfoundland during the 2d; on the 3d the storm was central in N. 50°, W. 43°, whence it advanced to N. 51°,

W. 38° by the 4th, without evidence of marked energy. Subsequent to the 4th the depression recurved to the southwest and apparently united with depression number 2 which had moved eastward from Newfoundland during that date.

4.—This depression is first located in N. 56°, W. 24°, under date of the 11th, whence it had advanced from the northwestward. On this day minimum pressure about 29.50 (749.3) was indicated, and moderate to fresh gales prevailed east of the fortieth meridian; by the 12th the storm-centre had moved to about N. 58°, W. 16°, with a marked decrease in pressure, after which it advanced beyond the region of reports.

5.—This depression passed east-northeast from Newfoundland during the 12th, and was central on the 13th in about N. 54°, W. 41°; from thence it moved south of east to N. 52°, W. 25° by the 14th, after which it disappeared to the northward, being unattended throughout by noteworthy features.

6.—This depression was a continuation of land low area number v which advanced eastward over the Gulf of Saint Lawrence during the 16th; on the 17th the storm was central over Newfoundland, whence it passed southeast over the Grand Banks by the 18th, with minimum pressure about 29.70 (754.4); from this position the storm-centre moved northeast to N. 51°, W. 43° by the 19th, where it remained nearly stationary during that and the succeeding date, after which it advanced to the thirty-second meridian, and, subsequent to the 21st, disappeared to the northward.

7.—This depression apparently developed off the southern edge of the Banks of Newfoundland during the 21st, and moved northeast to N. 45°, W. 44° by the 22d, where minimum pressure about 29.70 (754.4) was shown; by the 23d the centre of disturbance had advanced northeast to N. 51°, W. 36°, with a decrease of about .30 of an inch in central pressure, after which it recurved westward and apparently united with depression number 8 which had advanced from Newfoundland.

8.—This depression moved eastward over the northern extremity of Newfoundland during the morning of the 23d, and by the 24th had advanced eastward to the fortieth meridian, where pressure ranging to about 29.20 (741.7) and strong to whole gales were reported; by the 25th the storm-centre had passed to N. 53°, W. 31°, with an apparent slight decrease in pressure, after which it recurved to the northwest and remained nearly stationary in the vicinity of the fifty-fifth parallel during the two succeeding dates. Although the generally stormy weather and low barometric pressure which prevailed over the eastern portion of the ocean subsequent to the 26th would seem to indicate an eastward movement of this depression, reports at hand will not admit of determining its track east of the thirtieth meridian.

9.—This depression first appeared to the southward of Nova Scotia on the 27th, whence it moved rapidly east-northeast over the Banks of Newfoundland by the 28th, and remained nearly stationary in about N. 47°, W. 45° during that and the following date, with minimum pressure about 29.40 (746.7), and fresh to strong gales; by the 30th the centre of depression had advanced to N. 51°, W. 41°, with an apparent decrease in pressure and strong to whole gales to the fortieth parallel.

OCEAN ICE.

On chart i the following positions of icebergs and field ice reported during the month are shown by ruled shading:

1st.—S. S. "Lake Superior," off Cape Race, several large bergs; s. s. "Wandrahm," from Cape Race to Cape Saint Mary, several bergs; s. s. "Suez," off Cape Race, bergs.

2d.—S. S. "Siberian," N. 46° 00', W. 51° 30', three huge bergs, and in N. 46° 30', W. 54° 30', four large bergs and pieces.

3d.—S. S. "Barcelona," Cape Race to 30 miles west of Cape Saint Mary, numerous large bergs 15 miles off land.

4th.—S. S. "Oregon," N. 46° 48', W. 56° 06', huge bergs; s. s. "Sarmatian," 10 miles south of Cape Race, four large bergs; s. s. "State of Pennsylvania," N. 47° 02', W. 48° 37', a large berg and several pieces.

5th.—S. S. "State of Pennsylvania," N. 47° 00', W. 48° 36', a large berg; bark "Moselle," from Cape George to Pictou Island, solid field ice.

6th.—S. S. "Nova Scotian," N. 47° 36', W. 52° 35', to Saint John's, Newfoundland, several bergs.

7th.—S. S. "Nova Scotian," Saint John's to Cape Pine, bergs, the last one in N. 46° 22', W. 53° 30'; s. s. "Sarmatian," off Cape Race, three large bergs.

9th.—S. S. "Portia," Saint John's to Cape Race, numerous bergs; s. s. "Buenos Ayrean," N. 46° 40', W. 52° 34', a berg; s. s. "Toronto," N. 46° 50', W. 53° 00', several medium bergs.

10th.—Several icebergs off the harbor of Saint John's, Newfoundland; s. s. "Greetlands," Saint John's Harbor to Cape Race, numerous bergs; s. s. "Concordia," off Cape Race, two small bergs; s. s. "Borean," N. 46° 23', W. 52° 54', a small berg, N. 46° 27', W. 52° 43', a large berg, N. 46° 32', W. 52° 27', a large berg.

12th.—Schr. "Dove" crushed by ice off Cape John.

13th.—S. S. "Coventry," Cape Race in sight wnw., true, twenty bergs; s. s. "Ontario," fifty miles east of Cape Race to Cape Race, numerous bergs.

14th.—S. S. "Minnesota," N. 43° 38', W. 43° 24', several bergs, N. 46° 43', W. 52° 05', a berg; s. s. "Phœnician," near Cape Race, several bergs; s. s. "Rhein," N. 43° 38', W. 43° 24', several bergs nw. fifteen miles.

15th.—S. S. "Bengore Head," N. 47° 43', W. 51° 52', to Cape Pine nw., bergs.

16th.—S. S. "Sarnia," N. 46° 39', W. 52° 54', several medium sized bergs.

17th.—S. S. "Grecian," N. 46° 59', W. 51° 55', a berg; s. s. "Lake Winnipeg," from 60 miles ene. of Cape Race to Cape Pine, a number of bergs.

18th.—A large iceberg grounded in the narrows at Saint John's, N. F.; s. s. "Siberian," Trepassy Bay, 2 medium bergs; off Cape Race, 20 large and small bergs; 24' ne. from Cape Race, 10 small bergs and smaller ones awash; ship "Loyal," Strait of Belle Isle, a huge berg.

19th.—S. S. "Aleides," Strait of Belle Isle, numerous bergs.

20th.—S. S. "Peruvian," Saint John's to Cape Race, a number of bergs; s. s. "Glendale," N. 46° 34', W. 53° 05', an immense number of bergs.

21st.—N. 45° 07', W. 48° 17', two immense bergs, and in N. 45° 09', W. 48° 05', a large berg; s. s. "Oregon," N. 52° 40', W. 53° 00', a huge berg and several large lumps.

22d.—Straits of Belle Isle reported clear of field ice, but full of bergs; s. s. "Lake Superior," off Cape Race, quantity of small bergs.

23d.—S. S. "State of Pennsylvania," N. 46° 26', W. 52° 42', three large bergs, and in N. 45° 51', W. 53° 52', a large berg; during the 23d and 24th, from N. 46° 26', W. 52° 33', to N. 45° 55', W. 53° 44', four large bergs.

25th.—S. S. "Damara," N. 48° 00', W. 47° 50', an iceberg, and on the following day saw several large bergs on both sides of Cape Race; some aground.

26th.—S. S. "Glendale," from Little Bay along the coast to Cape Race, an immense number of large bergs; some aground.

29th.—S. S. "Montreal," twenty miles east of Belle Isle, two large bergs; encountered a heavy belt of field ice in the straits; was detained six hours in passing through a belt of field ice across the straits from Point Amour to the south shore.

30th.—S. S. "State of Georgia," N. 46° 33', W. 52° 47', to N. 45° 49', W. 54° 54', six bergs; s. s. "Circe," fifteen miles east from Point Amour, heavy field ice; was stopped seven hours by ice, and did not get clear until July 1st, when fifteen miles west from Greenly.

On chart i are exhibited the limits within which ice has been reported for June, 1888. The easternmost and southernmost ice was passed on the 14th in N. 43° 38', W. 43° 24', by the s. s. "Minnesota." Ice was most frequently encountered along the coast of Newfoundland between Saint John's and Cape Pine. From the 18th to the 22d numerous icebergs were

reported in the Straits of Belle Isle, and during the last two days of the month vessels were detained in the Straits by heavy field ice.

As compared with the ice record for May, 1888, the southern limit of ice was about two degrees farther north, while the eastern limit was extended about two degrees. The breaking up of ice to the northward of Newfoundland permitted vessels to effect the passage of Belle Isle Straits during the latter half of the month. Small differences are shown in the aggregate quantity of ice reported along the east and south coasts of Newfoundland and over the Grand Banks.

As compared with the corresponding month of previous years, the southward movement of ice massed to the northward of Newfoundland and along the coast of Labrador has been seasonable, the records showing that the Belle Isle Straits route has usually been available during June. Along the east and south coasts of Newfoundland the ice corresponded closely in quantity with the June average; over the Banks of Newfoundland it was deficient. The southernmost ice reported was over three degrees north of the average southern limit for the month, while the easternmost position in which ice was observed was about one and one-half degrees west of the average eastern limit.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
June, 1883.....	40 28	51 45	June, 1883.....	48 14	42 43
June, 1884.....	40 42	47 49	June, 1884.....	44 00	45 23
June, 1885.....	39 38	48 12	June, 1885.....	45 14	41 12
June, 1886.....	40 30	53 00	June, 1886.....	49 15	40 00
June, 1887.....	40 40	48 34	June, 1887.....	43 22	39 19
June, 1888.....	43 38	43 24	June, 1888.....	43 38	43 24

FOG.

The limits of fog-belts to the westward of the fortieth meridian are shown on chart i by dotted shading. As compared with the chart of the preceding month, the southern limit of the Newfoundland fog-belt has contracted about one degree, and the number of days for which fog was reported, twenty-three, was six more than the aggregate number of foggy days reported for the preceding month. To the westward of the sixtieth meridian fog was reported for a total of twenty-four days, as compared with twenty-seven days for May.

During the prevalence of fog near Newfoundland, south to east winds preceding or attending the passage of cyclonic areas were noted on sixteen dates; in five instances the winds

were variable, with high barometric pressure, and on two days northwest winds prevailed, with rising barometer. To the southward of Nova Scotia, and off the middle Atlantic coast of the United States, the development of fog was, as a rule, dependent upon the cyclonic circulation of the winds, whereby the moisture laden air from over the Gulf Stream was drawn into that region.

The following are the limits of fog-areas on the north Atlantic Ocean during June, 1888, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
1	S. S. Trave.....	40 49	50 40	3 a. m.	40 55	50 30	8 a. m.
1	Brittania.....	40 20	73 07	8 a. m.	New York..		
1-2	Siberian.....	48 00	49 00	6 a. m.	46 30	54 30	2 p. m.
2	Trave.....	41 35	50 00	6 a. m.	41 47	48 20	9-30 a. m.
2	Fog at Saint John's, N. F.						
2-3	S. S. La Gascogne.....	40 30	67 27	7-32 p. m.	40 28	70 47	7-16 a. m.
2-3	Waesland.....	41 35	45 13	10-55 p. m.	40 51	47 07	8-10 a. m.
3	City of Berlin.....	43 43	41 10	11-45 a. m.	43 17	41 48	2-45 p. m.
4-5	Norrone.....	48 24	62 12	6-50 a. m.	46 18	60 05	6-40 a. m.
4-5	City of Berlin.....	41 35	45 22	4-12 a. m.	40 54	48 00	1-12 p. m.
6	Fog at Saint John's, N. F.						
6	Gellert.....	42 05	48 05		41 28	49 28	
7	S. S. Mair.....	41 54	52 49	3-31 a. m.	42 04	51 15	9-25 a. m.
7-8	Wieland.....	40 32	70 24	11-30 p. m.	40 37	70 00	1 a. m.
8	State of Nebraska.....	47 43	45 53	6 a. m.	46 25	49 05	6-45 p. m.
8	Sch. Nelson Bartlett.....	38 39	72 30	3 a. m.	38 56	72 12	4 p. m.
8	Fog at Saint John's, N. F.						
8	S. S. La Normandie.....	41 50	53 18	4 p. m.	41 35	55 28	
9	Colorado.....	Sandy Hook.					
9	Istrian.....	42 08	59 45	5 a. m.	42 53	63 12	7-20 p. m.
9	Eider.....	42 40	49 20	3-10 a. m.	42 18	53 11	2-33 p. m.
10	Fog at Saint John's, N. F.						
10	S. S. Hekla.....	40 19	71 50		40 24	68 10	
10-11	Rotterdam.....	42 09	45 48	3-02 p. m.	41 00	49 03	5-16 a. m.
11	Baltimore.....	40 12	67 20	10 a. m.	40 06	68 25	5-15 p. m.
11-12	Nova Scotian.....	Halifax		8 a. m.	43 02	64 39	4-18 a. m.
11-12	Fog at Saint John's, N. F.						
12	S. S. Rhaetia.....	44 20	44 10	6 a. m.	43 54	48 20	9 p. m.
12-13	Pavonia.....	10' E. Boston.		Light.	42 17	64 25	
13	Rhaetia.....	43 35	54 00	5 a. m.	42 58	54 35	Midnight.
13-14	Hekla.....	42 42	52 55		42 56	51 50	
15-16	Fog at Saint John's, N. F.						
15-16	S. S. Pavonia.....	41 58	52 12	2 p. m.	42 00	48 35	6 a. m.
15-16	Denmark.....	40 54	68 10		40 44	69 05	
16	Galileo.....	41 21	45 34	1-30 a. m.	40 31	48 32	4 p. m.
16-17	Minnesota.....	43 00	59 00	8 a. m.	42 00	65 00	Noon.
17	Venetian.....	43 11	50 51	8 a. m.	42 50	54 58	Midnight.
17	Eider.....	40 25	69 50	4-20 p. m.	40 22	67 30	12-30 p. m.
18	Samara.....	42 43	62 18	7 a. m.	42 40	63 55	1-40 p. m.
18-19	Sch. Annie G. O'Leary.....	43 39	61 02	noon.	41 36	60 53	Noon.
19	S. S. Buffalo.....	42 12	59 35	2-30 a. m.	42 16	60 14	5 a. m.
20	Trave.....	40 50	68 40	6 p. m.	Sandy Hook.		
22	Borderer.....	42 18	68 00		42 20	69 30	
22-23	Chateau Lafite.....	40 33	67 40		40 31	70 40	
23	P. Calland.....	42 46	57 20	4-22 p. m.	42 52	56 19	7-46 p. m.
23	La Bretagne.....	41 10	68 20	4 a. m.	40 55	69 40	4 p. m.
23-24	Germanic.....	42 10	51 00	6-30 p. m.	43 00	48 45	1-30 a. m.
24-25	Rugia.....	40 57	64 00	4 p. m.	40 33	70 28	8 p. m.
25	Elbe.....	41 15	61 50	4 a. m.	41 10	62 10	5-10 a. m.
25-26	Westernland.....	40 29	67 33	6-15 p. m.	40 36	70 21	4-15 a. m.
26	Brittania.....	43 48	49 10	10-48 a. m.	43 27	50 19	Noon.
27	City of Richmond.....	41 41	48 20	11-15 a. m.	41 14	49 20	3-15 p. m.
27-28	Brittania.....	41 52	54 20	1 p. m.	41 44	57 30	9 a. m.
28-29	Bavarian.....	44 00	44 54	4 a. m.	42 50	48 50	2 a. m.
30	Bothnia.....	42 21	67 12		42 22	67 51	

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for June, 1888, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal, and subtracting when above.

The temperature was above the normal in the central and southern Rocky Mountain and plateau districts, in the lower lake region, Saint Lawrence and Ohio valleys, and in portions of the upper lake region, New England, middle and south Atlantic states; the greatest excess of temperature occurring over the region to the north of Lakes Erie and Huron, and in

western Texas and New Mexico. Elsewhere the month was colder than the average June, the deficiencies of temperature being greatest in northern California and southern Oregon, in the northern portions of Montana and Dakota, and in the lower Mississippi valley and west Gulf states.

The following are some of the most marked departures from normal temperatures at Signal Service stations:

Above normal.		Below normal.	
Santa Fe, N. Mex	3.1	Sacramento, Cal.....	4.3
El Paso, Tex.....	3.0	Rio Grande City, Tex.....	3.8
Fort Elliott, Tex.....	2.6	Roseburg, Oregon.....	3.7
Cheyenne, Wyo.....	2.3	New Orleans, La.....	3.7
Yuma, Ariz.....	1.6	San Antonio, Tex.....	3.0
Denver, Colo.....	1.4	San Francisco, Cal.....	3.0
Prescott, Ariz.....	1.4	Shreveport, La.....	2.8

It will be observed from the above table of extreme depart-